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Vikberg et al.

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(54) **DISTRIBUTION OF ACCESS CONTROL INFORMATION IN A NETWORK**

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H04W 12/08	(2009.01)
H04W 48/02	(2009.01)
H04W 84/04	(2009.01)

(52) **U.S. Cl.**
CPC ***H04L 63/101*** (2013.01); ***H04W 8/18*** (2013.01); ***H04W 12/08*** (2013.01); *H04W 48/02* (2013.01); *H04W 84/045* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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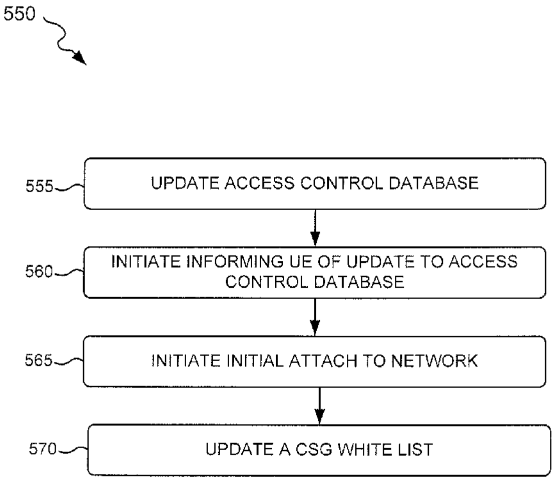
(57) **ABSTRACT**

Methods and systems described herein may provide for the updating, maintenance, and/or transference of a CSG White List that is stored on a user equipment. The CSG White List may be implemented to store information related to the access of CSG cells, such as, for example, femto cells. Additionally, methods and systems described herein may provide for the updating, maintenance, and/or transference of an access control database. The access control database may be stored in one or multiple devices in a communication system. The access control database may be implemented to store information regarding home nodes and which user equipment is allowed to access the femto cell or CSG cell provided by each home node.

15 Claims, 13 Drawing Sheets


550
555
UPDATE ACCESS CONTROL DATABASE
560
INITIATE INFORMING UE OF UPDATE TO ACCESS CONTROL DATABASE
565
INITIATE INITIAL ATTACH TO NETWORK
570
UPDATE A CSG WHITE LIST

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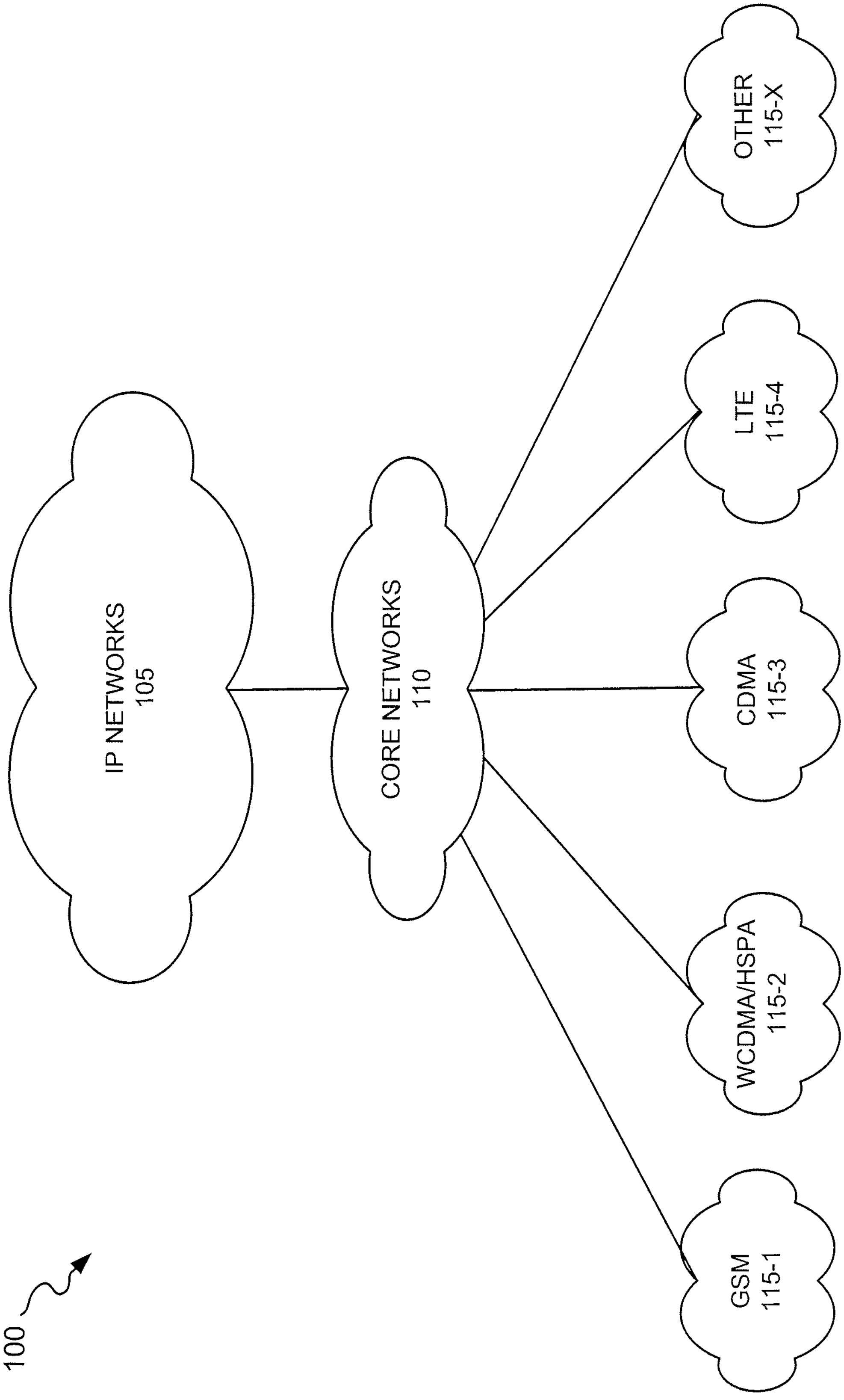

100
IP NETWORKS
105
CORE NETWORKS
110
GSM
115-1
WCDMA/HSPA
115-2
CDMA
115-3
LTE
115-4
OTHER
115-X

FIG. 1A

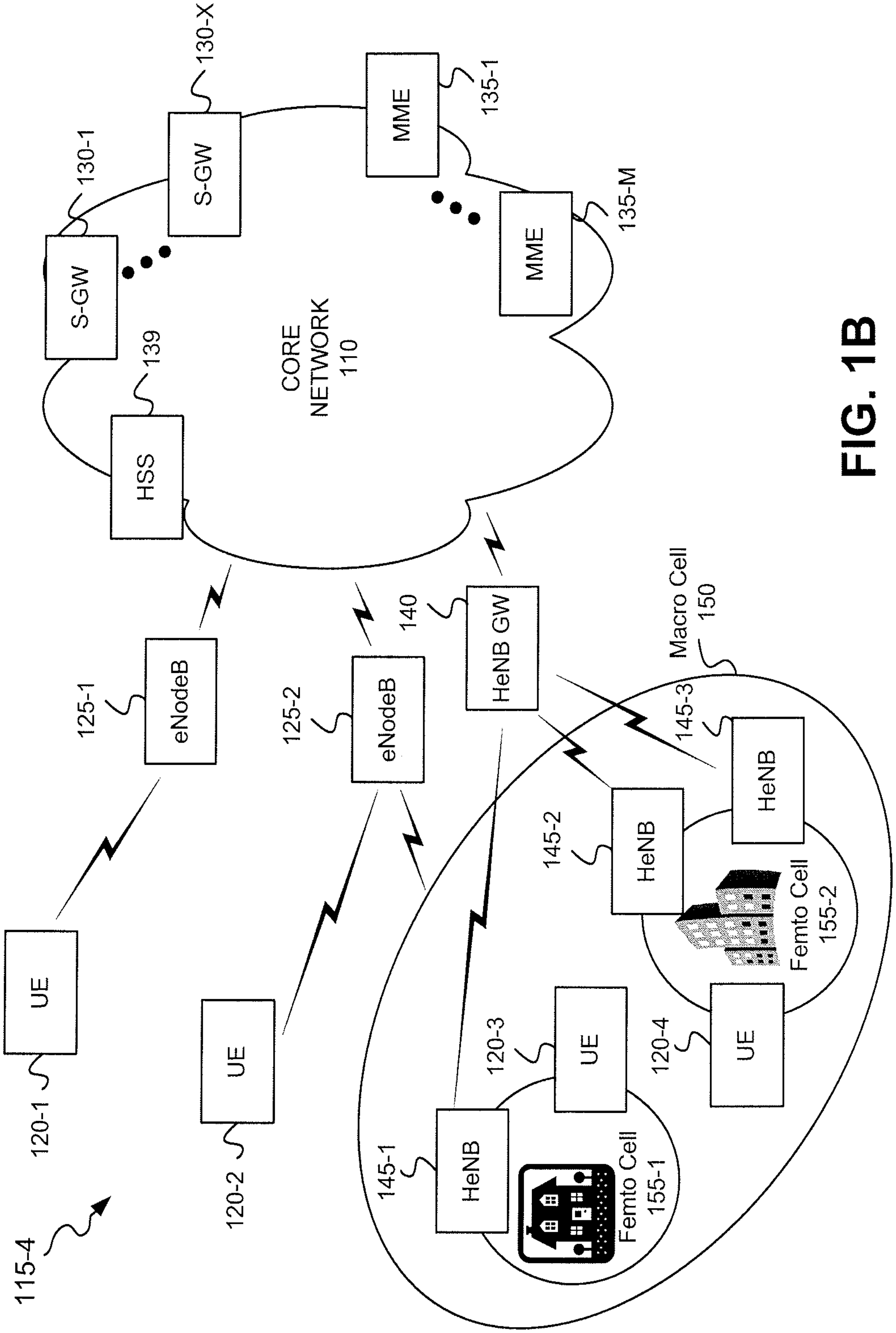

115-4
CORE NETWORK 110
HSS
139
S-GW
130-1
S-GW
130-X
MME
135-1
MME
135-M
eNodeB
125-1
eNodeB
125-2
HeNB GW
140
Macro Cell 150
HeNB
145-1
HeNB
145-2
HeNB
145-3
Femto Cell 155-1
Femto Cell 155-2
UE
120-1
UE
120-2
UE
120-3
UE
120-4

FIG. 1B

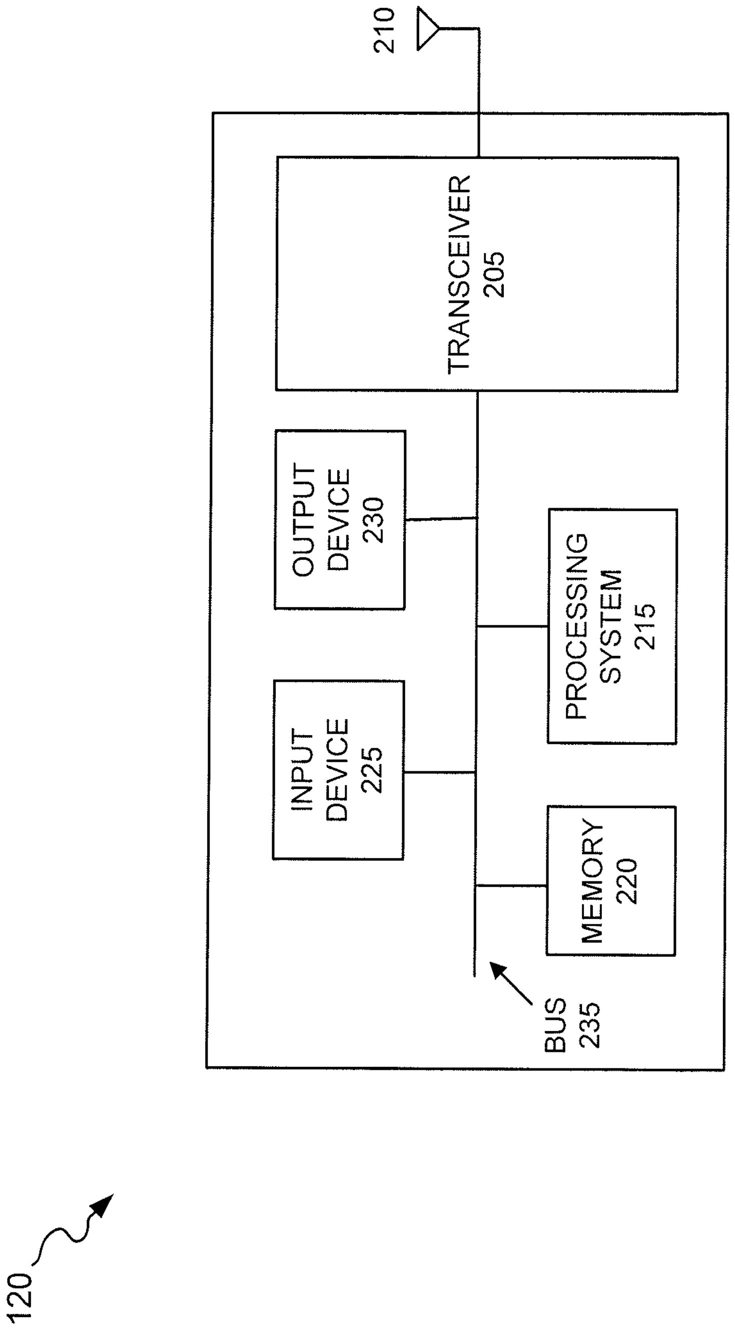
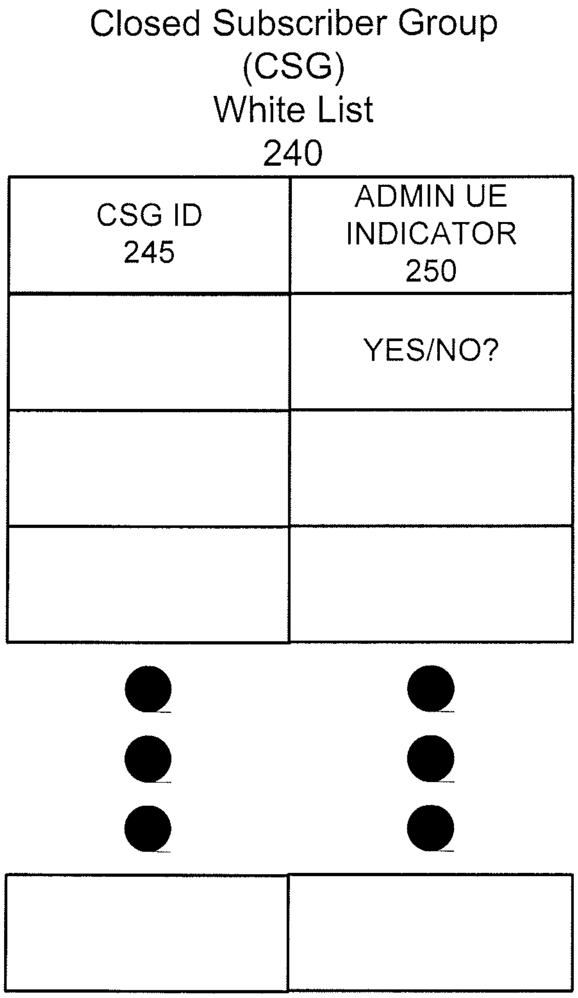

210
TRANSCEIVER
205
OUTPUT
DEVICE
230
INPUT
DEVICE
225
PROCESSING
SYSTEM
215
MEMORY
220
BUS
235
120

FIG. 2A



Closed Subscriber Group
(CSG)
White List
240

CSG ID 245	ADMIN UE INDICATOR 250
	YES/NO?
● ● ●	● ● ●

FIG. 2B

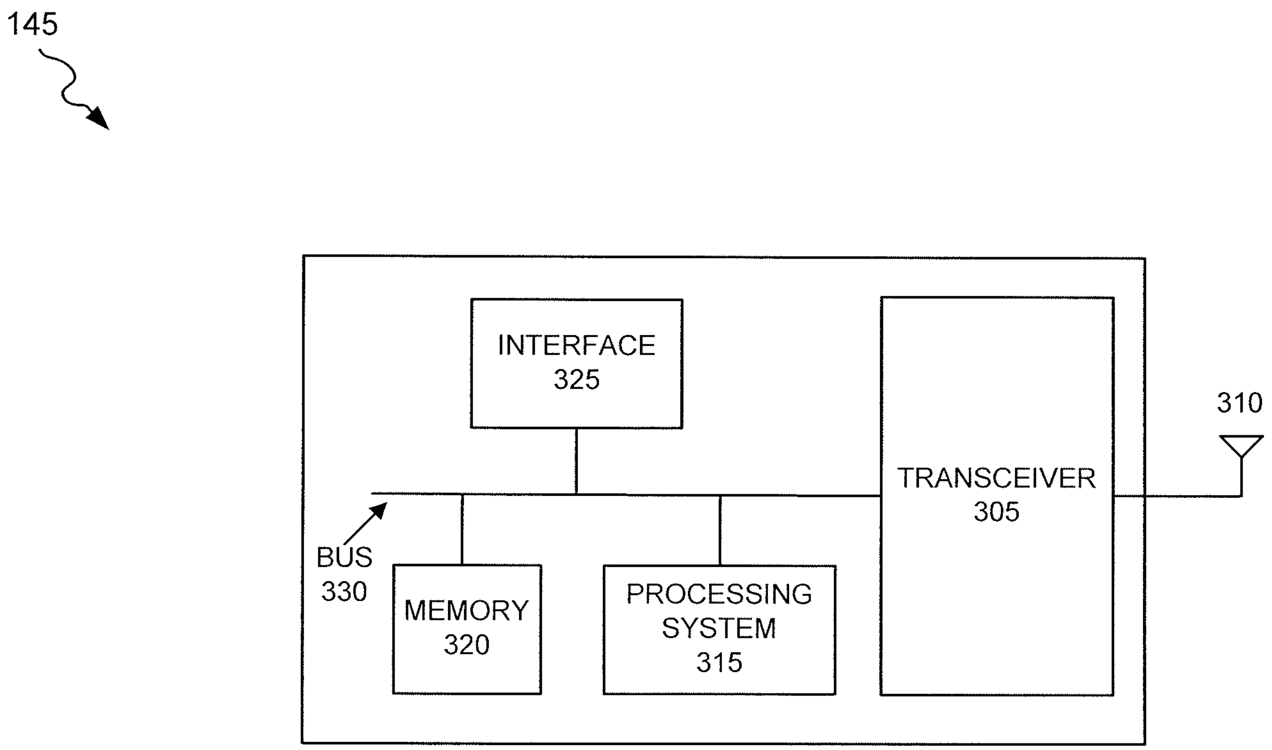

145
INTERFACE
325
310
TRANSCEIVER
305
BUS
330
MEMORY
320
PROCESSING
SYSTEM
315

FIG. 3A

Access Control
Database
330

CSG ID 335	ADMIN UE 340	ALLOWED USERS 345
⋮	⋮	⋮

FIG. 3B

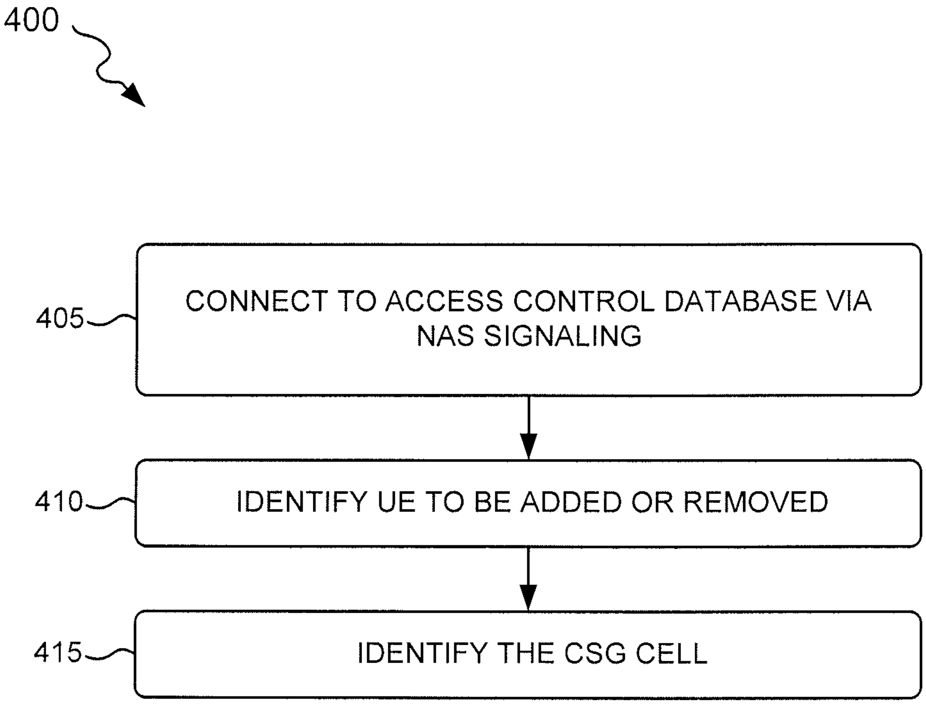

400
405
CONNECT TO ACCESS CONTROL DATABASE VIA NAS SIGNALING
410
IDENTIFY UE TO BE ADDED OR REMOVED
415
IDENTIFY THE CSG CELL

FIG. 4

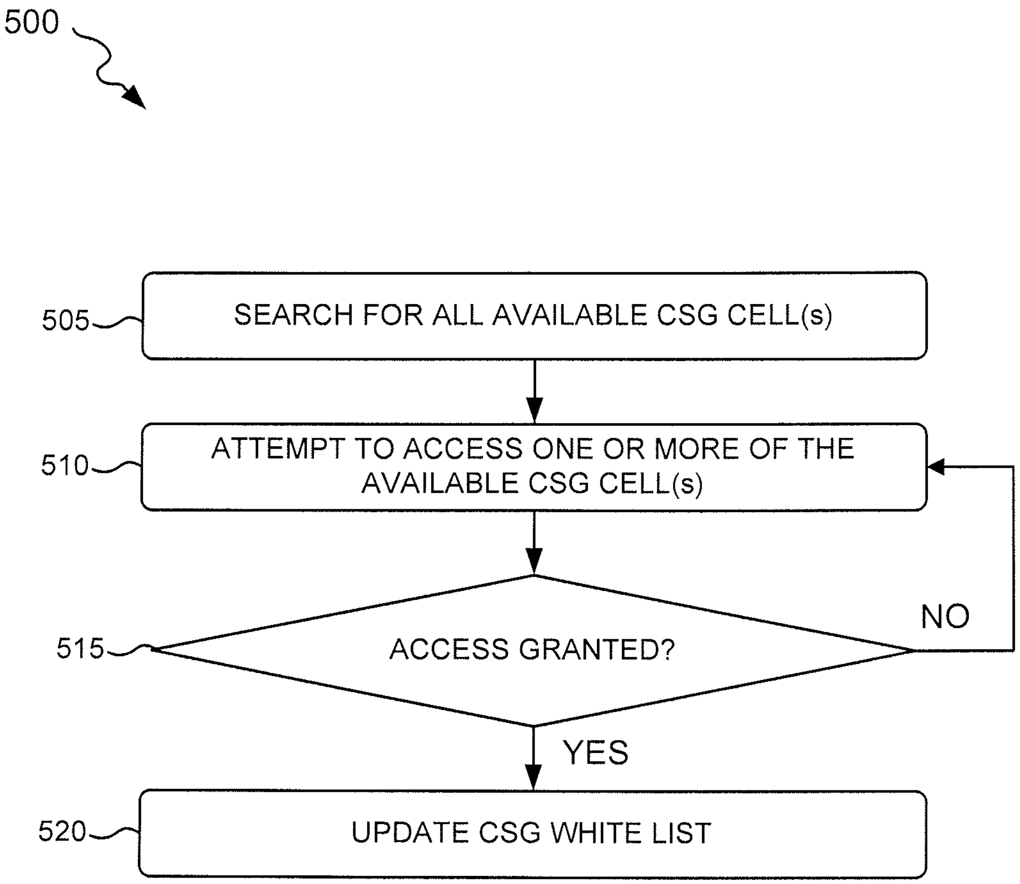

500
505
SEARCH FOR ALL AVAILABLE CSG CELL(s)
510
ATTEMPT TO ACCESS ONE OR MORE OF THE AVAILABLE CSG CELL(s)
515
ACCESS GRANTED?
NO
YES
520
UPDATE CSG WHITE LIST

FIG. 5A

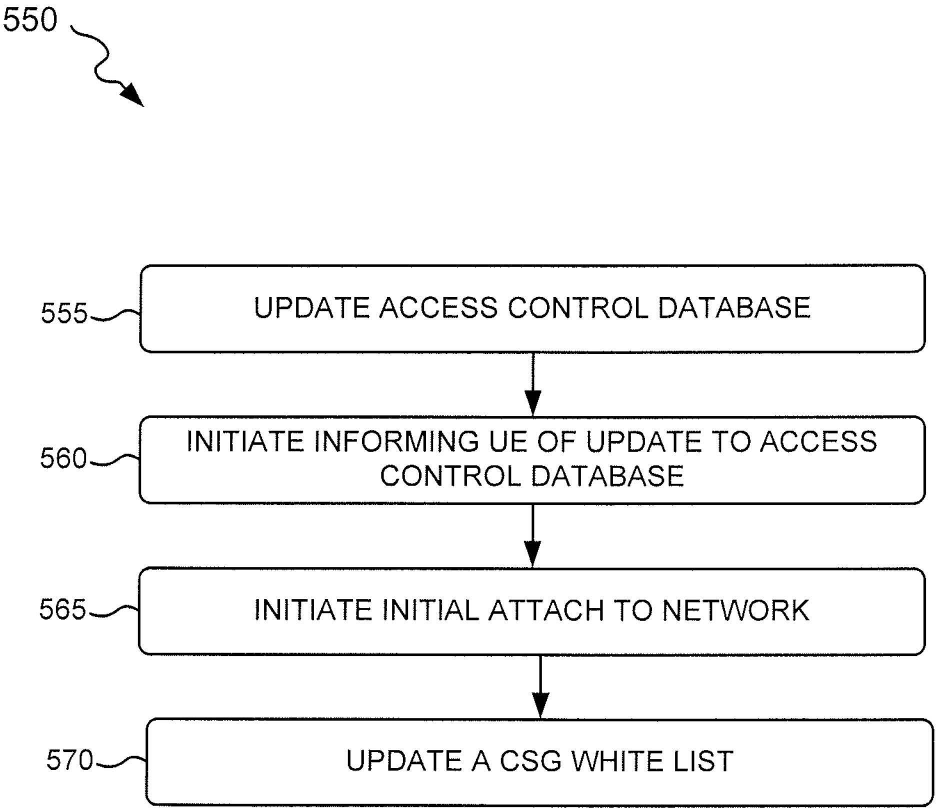

550
555
UPDATE ACCESS CONTROL DATABASE
560
INITIATE INFORMING UE OF UPDATE TO ACCESS CONTROL DATABASE
565
INITIATE INITIAL ATTACH TO NETWORK
570
UPDATE A CSG WHITE LIST

FIG. 5B

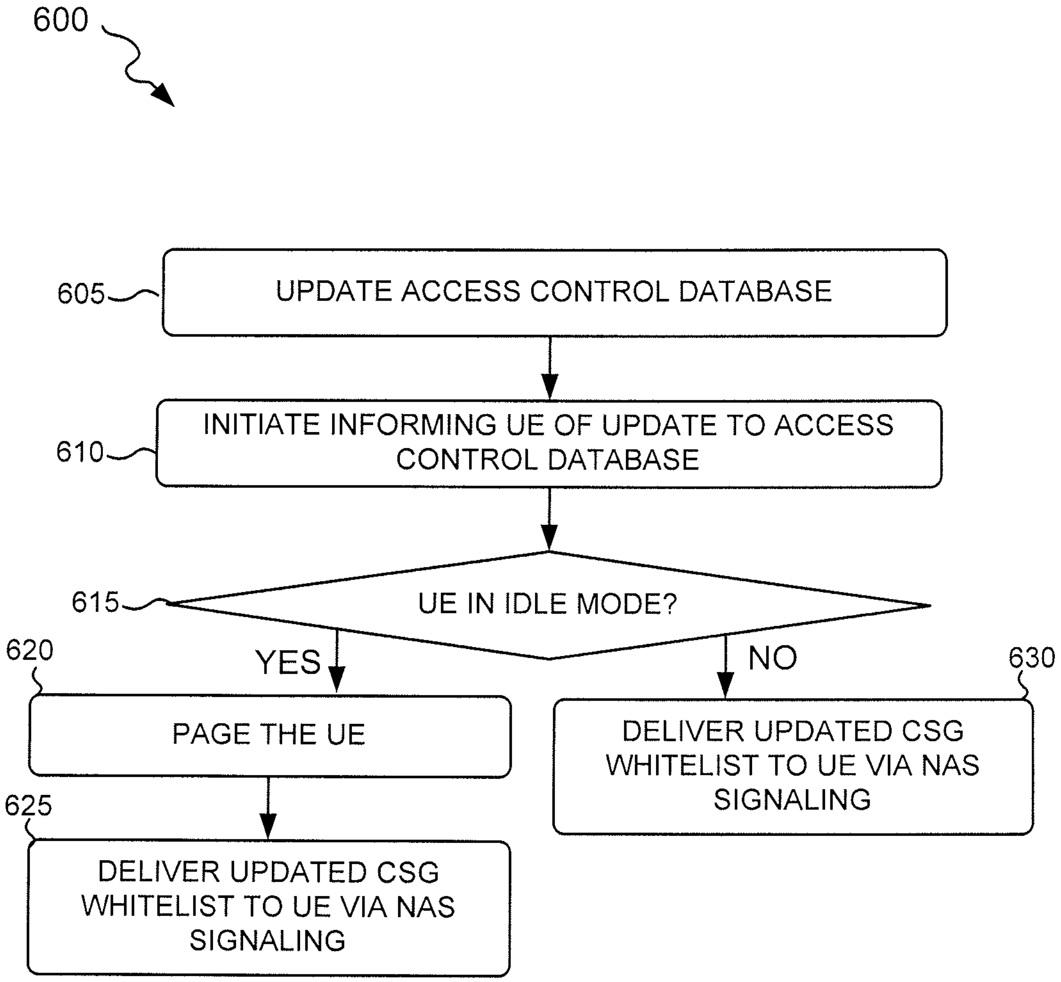

600
605
UPDATE ACCESS CONTROL DATABASE
610
INITIATE INFORMING UE OF UPDATE TO ACCESS CONTROL DATABASE
615
UE IN IDLE MODE?
YES
NO
620
PAGE THE UE
625
DELIVER UPDATED CSG WHITELIST TO UE VIA NAS SIGNALING
630
DELIVER UPDATED CSG WHITELIST TO UE VIA NAS SIGNALING

FIG. 6A

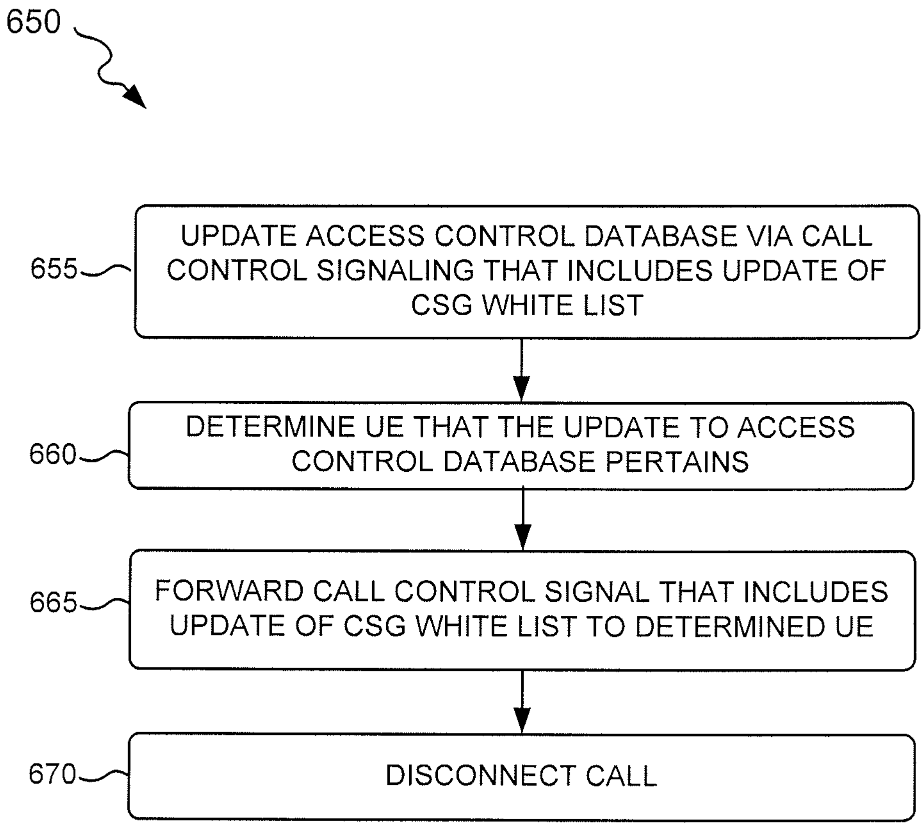

650
655
UPDATE ACCESS CONTROL DATABASE VIA CALL CONTROL SIGNALING THAT INCLUDES UPDATE OF CSG WHITE LIST
660
DETERMINE UE THAT THE UPDATE TO ACCESS CONTROL DATABASE PERTAINS
665
FORWARD CALL CONTROL SIGNAL THAT INCLUDES UPDATE OF CSG WHITE LIST TO DETERMINED UE
670
DISCONNECT CALL

FIG. 6B

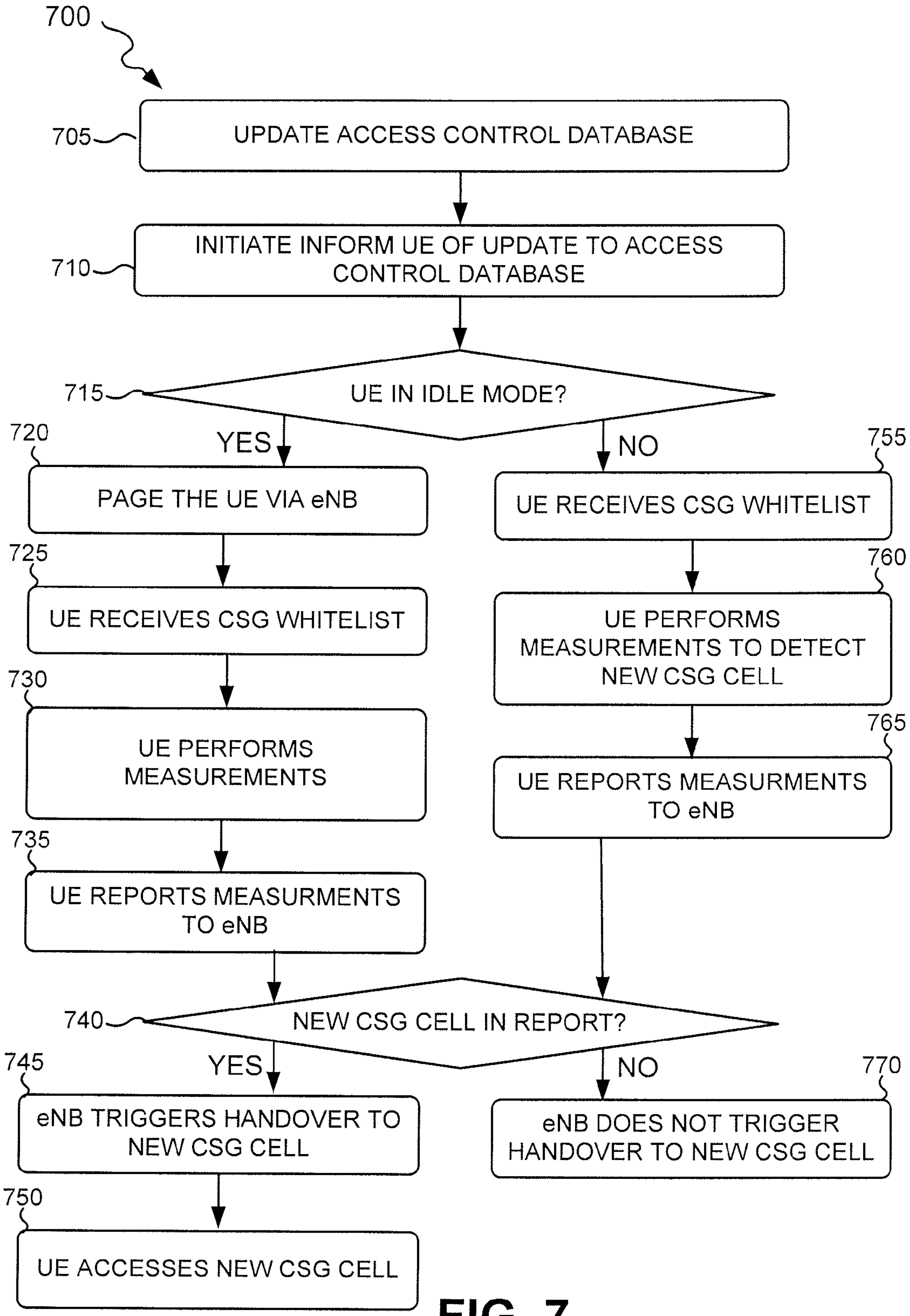

700
705
UPDATE ACCESS CONTROL DATABASE
710
INITIATE INFORM UE OF UPDATE TO ACCESS CONTROL DATABASE
715
UE IN IDLE MODE?
YES
NO
720
PAGE THE UE VIA eNB
725
UE RECEIVES CSG WHITELIST
730
UE PERFORMS MEASUREMENTS
735
UE REPORTS MEASURMENTS TO eNB
755
UE RECEIVES CSG WHITELIST
760
UE PERFORMS MEASUREMENTS TO DETECT NEW CSG CELL
765
UE REPORTS MEASURMENTS TO eNB
740
NEW CSG CELL IN REPORT?
YES
NO
745
eNB TRIGGERS HANDOVER TO NEW CSG CELL
750
UE ACCESSES NEW CSG CELL
770
eNB DOES NOT TRIGGER HANDOVER TO NEW CSG CELL

FIG. 7

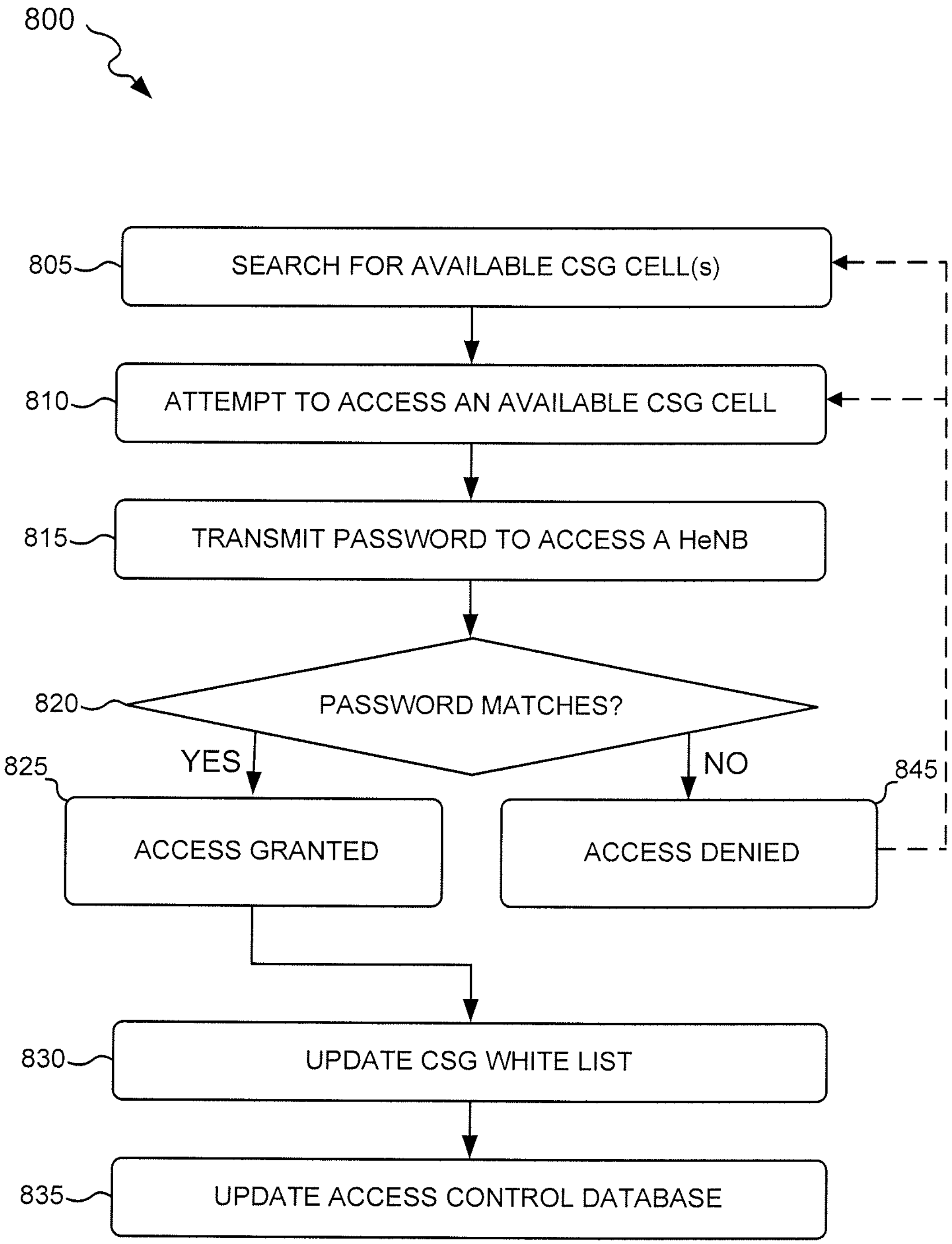

800
805
SEARCH FOR AVAILABLE CSG CELL(s)
810
ATTEMPT TO ACCESS AN AVAILABLE CSG CELL
815
TRANSMIT PASSWORD TO ACCESS A HeNB
820
PASSWORD MATCHES?
YES
NO
825
ACCESS GRANTED
845
ACCESS DENIED
830
UPDATE CSG WHITE LIST
835
UPDATE ACCESS CONTROL DATABASE

FIG. 8

DISTRIBUTION OF ACCESS CONTROL INFORMATION IN A NETWORK

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a 35 U.S.C. §371 national stage application of PCT International Application No. PCT/SE2009/050022, filed on 14 Jan. 2009, the disclosure and content of which is incorporated by reference herein in its entirety. The above-referenced PCT International Application was published in the English language as International Publication No. WO 2010/082874 A1 on 22 Jul. 2010.

TECHNICAL FIELD

Implementations described herein relate generally to communication systems. More particularly, implementations described herein relate to schemes for distributing access control information in the communication system.

BACKGROUND

Specification is ongoing in 3rd Generation Partnership Project (3GPP) for home nodes in the Wideband Code Division Multiple Access/Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (WCDMA/UTRAN) and in the Evolved Universal Terrestrial Radio Access Network (EUTRAN). In a EUTRAN environment, the home node may be referred to as a home E-UTRAN NodeB (HeNB). In a UTRAN environment, the home node may be referred to as a home NodeB (HNB). The home node may include a home base station that would provide coverage for the end users and would be connected to the core network using some kind of Internet Protocol (IP)-based transmission. The radio coverage provided is called a femto cell. One of the main drivers for this type of local access is to provide cheaper call or transaction rates/charges when connected via the home node versus other nodes (e.g., eNodeB or NodeB).

The home node would, in most cases, utilize the end user's already existing broadband connection (e.g., cable, any DSL based method denoted as x Digital Subscriber Line (xDSL) family of technologies where Asymmetric Digital Subscriber Line (ADSL) is currently the most common one) to achieve connectivity to the operator's mobile core network and possibly to other nodes (e.g., eNodeB, NodeB, home node). Current 3GPP discussions include possibilities to perform access control in a network having femto cells. For example, discussions address the case when neither the user equipment (UE) nor the core network is allowed to be modified (i.e., how to support legacy pre-Release 8 UEs that do not support the closed subscriber group (CSG) concept). In the System Architecture Evolution/Long Term Evolution SAE/LTE 3GPP Rel-8 standards, a concept known as a CSG has been introduced. With the CSG, particular HeNBs can be associated with certain UEs, where only these associated UEs are allowed to access certain HeNBs. It will be appreciated that the CSG is actually associated with a group of subscribers rather than UEs, but for purposes of discussion, the term UE will often be used as the entity of which the CSG is formed. The allowed CSG Identities (CGS-IDs) are stored in the UE in a CSG White List. Each HeNB broadcasts, in system information, both a CSG indicator and the CSG-ID allocated to it. In this way, the UE can determine, by reading the CSG-ID from the system information and comparing this to the content of the CSG White List, whether it is allowed to access a particular HeNB. The allowed CSGs for the UE are also stored in the core network so that the core network can perform an ultimate access control (e.g., in case the UE has an outdated CSG White List or misbehaves (e.g., a hacked UE)). This variant of access control is called core network-based access control.

Current discussion also include a radio access network (RAN)-based access control (e.g., in the WCDMA/UTRAN) to support legacy UEs (i.e., UEs without CSG support). In one implementation, the RAN may include an access control database (ACDB). The ACDB may store information regarding the HNBs and which UEs are allowed to access the femto cell or CSG cell provided by each HNB.

While the utilization of the CSG White List appears promising, the transfer of the CSG White list to the UEs is still open in the current discussions. Further, solutions for maintaining the ACDB have still yet to be specified and remain unresolved.

SUMMARY

It is an object to provide solutions relating to the maintenance, updating and/or transference of the CSG White List and the ACDB and/or improve the operability of devices within a communication system.

According to one aspect, a method may be performed in a communication system by a device that is communicatively coupled to the communication system. The communication system may include one or more closed subscriber group (CSG) cells. The method may include searching for the one or more CSG cells, attempting to access the one or more CSG cells, determining whether access to the one or more CSG cells is granted, and updating a CSG White List corresponding to the one or more CSG cells in which access is granted, where the CSG White List indicates to the device which of the one or more CSG cells the device is allowed to access.

According to another aspect, a method may be performed in a communication system by a device that is communicatively coupled to the communication system. The communication system may include one or more CSG cells. The method may include receiving an indication that an access control database has been updated, performing a power cycle to re-attach to the communication system based on the indication, and updating a CSG White List, where the CSG White List indicates to the device the one or more CSG cells the device is allowed to access.

According to yet another aspect, a method may be performed in a communication system that includes one or more CSG cells. The method may include updating an access control database that specifies which of one or more user equipments are allowed to access the one or more CSG cells, informing a device, which is communicatively coupled to one of the one or more user equipments to which the updating of the access control database pertains, of the updating of the access control database, and providing a CSG White List to the one of the one or more user equipments, where the CSG White List indicates to the one of the one or more user equipments the one or more CSG cells that the one of the one or more user equipments is allowed to access.

According to still another aspect, a method may be performed in a communication system that includes one or more CSG cells. The method may include receiving an update for an access control database that specifies which of one or more user equipments are allowed to access the one or more closed CSG cells, where the update is received based on call control signaling that includes an updated portion of a CSG White List that indicates the one or more CSG cells that the one or more user equipments are allowed to access, determining which of the one or more user equipments the update of the access control database pertains, forwarding the call control signaling that includes the updated portion of the CSG White List to the determined one or more user equipments or triggering a new call that includes the updated portion of the CSG White List to the determined one or more user equipments, and disconnecting from the determined one or more user equipments once the updated portion of the CSG White List is received.

According to another aspect, a method may be performed in a communication system by a device that is communicatively coupled to the communication system. The communication system may include one or more CSG cells. The method may include receiving a CSG White List triggered by an access control database having been updated, where the CSG White List indicates the one or more CSG cells that the device is allowed to access, performing measurements to detect the one or more CSG cells, reporting the measurements, receiving a handover message that authorizes a handoff to one of the one or more CSG cells when the one of the one or more CSG cells was included in the reporting, and accessing the one of the one or more CSG cells according to the handover message.

According to yet another aspect, a method may be performed in a communication system by a device that is communicatively coupled to the communication system. The communication system may include one or more CSG cells. The method may include searching for one or more base stations associated with the one or more CSG cells, transmitting access information to one of the one or more base stations, where the access information includes administrative level access information or non-administrative level access information, receiving an access grant to one of the one or more CSG cells or an access denial to one of the one or more CSG cells based on the transmitted access information, and updating a CSG White List when the access grant is received, where the updating of the CSG White List database includes whether the device corresponds to an administrative level device or a non-administrative level device, and where the CSG White List indicates the one or more CSG cells that the device is allowed to access.

According to still another aspect, a method may be performed in a communication system by a device that is communicatively coupled to the communication system. The communication system may include one or more CSG cells. The method may include connecting to an access control database utilizing non-access stratum (NAS) signaling, where the access control database specifies which of one or more user equipments are allowed to access the one or more CSG cells, identifying one of the one or more user equipments to be added or removed from the access control database, and identifying one of the one or more CSG cells to which the one of the one or more user equipments is granted access in correspondence to the one of the one or more user equipments to be added, or identifying the one of the one or more CSG cells to which the one of the one or more user equipments is denied access in correspondence to the one of the one or more user equipments to be removed.

According to yet another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to search for the one or more CSG cells, attempt to access the one or more CSG cells, determine whether access to the one or more CSG cells is granted, and update a CSG White List corresponding to the one or more CSG cells in which access is granted, where the CSG White List indicates to the device which of the one or more CSG cells the device is allowed to access.

According to another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to receive an indication that an access control database has been updated, perform a power cycle to re-attach to the communication system based on the indication, and update a CSG White List that indicates to the device the one or more CSG cells the device is allowed to access.

According to still another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to receive an indication that an access control database has been updated, where the access control database specifies which of one or more user equipments are allowed to access the one or more CSG cells, determine which of the one or more equipments that the updated access control database pertains, and deliver an updated CSG White List to the determined one or more user equipments, where the updated CSG White List indicates to the determined one or more user equipments which of the one or more CSG cells the determined one or more user equipments are allowed to access.

According to yet another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to receive an update for an access control database that specifies which of one or more user equipments are allowed to access one or more CSG cells, where the update is received based on call control signaling that includes an updated portion of a CSG White List that indicates the one or more CSG cells that the one or more user equipments are allowed to access, determine which of the one or more user equipments the update of the access control database pertains, forward the call control signaling that includes the updated portion of the CSG White List to the determined one or more user equipments or trigger a new call that includes the updated portion of the CSG White List to the determined one or more user equipments, and disconnect from the determined one or more user equipments once the updated portion of the CSG White List is forwarded.

According to another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to receive a CSG White List triggered by an access control database having been updated, where the CSG White List indicates the one or more CSG cells that the device is allowed to access, perform measurements to detect the one or more CSG cells, report the measurements, receive a handover message to one of the one or more CSG cells when the one of the one or more CSG cells was included in the reporting, and access the one of the one or more CSG cells according to the handover message.

According to still another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to search for one or more base stations associated with the one or more CSG cells, transmit access information to one of the one or more base stations, where the access information includes administrative level access information or non-administrative level access information,

receive an access grant to one of the one or more CSG cells or an access denial to one of the one or more CSG cells based on the transmitted access information, and update a CSG White List when the access grant is received, where the updating of the CSG White List database includes whether the device corresponds to an administrative level device or a non-administrative level device, and where the CSG White List indicates the one or more CSG cells that the device is allowed to access.

According to yet another aspect, a device capable of operating in a communication system having one or more CSG cells, the device may include a processing system to connect to an access control database utilizing non-access stratum (NAS) signaling, where the access control database specifies which of one or more user equipments are allowed to access the one or more CSG cells, identify one of the one or more user equipments to be added or removed from the access control database, and identify one of the one or more CSG cells to which the one of the one or more user equipments is granted access in correspondence to the one of the one or more user equipments to be added, or identifying the one of the one or more CSG cells to which the one of the one or more user equipments is denied access in correspondence to the one of the one or more user equipments to be removed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a diagram illustrating an exemplary communication system in which the concepts described herein may be implemented;

FIG. **1**B is a diagram illustrating an exemplary implementation of a LTE network in the communication system of FIG. **1**A in which systems and methods may be implemented;

FIG. **2**A is a diagram illustrating exemplary components of a UE depicted in FIG. **1**B;

FIG. **2**B is a diagram illustrating an exemplary CSG White list;

FIG. **3**A is a diagram illustrating exemplary components of a Home E-UTRAN NodeB (HeNB) depicted in FIG. **1**B;

FIG. **3**B is a diagram illustrating an exemplary access control database (ACDB);

FIG. **4** is a flow diagram illustrating an exemplary process for updating the ACDB;

FIGS. **5**A-**7** are flow diagrams illustrating exemplary processes for updating the CSG White List; and

FIG. **8** is a flow diagram illustrating an exemplary process for updating the CSG White List and the ACDB.

DETAILED DESCRIPTION

The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements. Also, the following description does not limit the invention.

The phrase "CSG cell," as used herein, is intended to be broadly interpreted to include, for example, a femto cell, a pico cell, a micro cell, a macro cell, or some other type of CSG configuration.

The concepts described herein relate to a communication system. The communication system is intended to be broadly interpreted to include any type of wireless network, such as a cellular network and/or a mobile network (e.g., Global System for Mobile Communications (GSM), LTE, WCDMA, Ultra Mobile Broadband (UMB), UMTS, Code Division Multiple Access 2000 (CDMA2000), ad hoc networks, High-Speed Packet Access (HSPA), etc.), and a non-cellular network (e.g., Wireless Fidelity (Wi-Fi), Worldwide Interoperability for Microwave Access (WiMax), etc.). In this regard, it will be appreciated that the concepts described herein are not platform dependent and may be implemented within a wide variety of communication systems.

Embodiments described herein may provide a scheme for end users to dynamically update access control information both in the communication system and in a user terminal (e.g., a UE). The embodiments described herein may solve the problems related to identifying users allowed to update the access control information, identifying CSG cells that access control is being maintained for, identifying end users that are allowed to access the CSG cell, maintaining information in the network-based ACDB and in the UE-based CSG White List, as well as provide advantages that necessarily flow therefrom. For example, the UE may avoid performing unnecessary access attempts to a particular CSG cell.

FIG. **1**A is a diagram illustrating an exemplary communication system **100** in which the concepts described herein may be implemented. As illustrated, communication system **100** may include Internet Protocol (IP) networks **105**, core networks **110**, and different radio access networks (RANs), such as, for example, GSM **115-1**, WCDMA/HSPA **115-2**, CDMA **115-3**, LTE **115-4**, and other networks **115**-X (e.g., time division-synchronous CDMA (TD-SCDMA)). Although not illustrated, communication system **100** may include other types of networks, such as, for example, circuit-switched networks. The connections between RANs **115**, core networks **110** and IP networks **105** are exemplary.

FIG. **1**B is a diagram illustrating an exemplary implementation of LTE network **115-4** in communication system **100** in which systems and methods described herein may be implemented. As illustrated in FIG. **1**B, LTE **115-4** may include user equipments (UEs) **120-1** through **120-4** (referred to generically as UE **120**), E-UTRAN NodeBs (eNodeBs) **125-1** and **125-2** (referred to generically as eNodeB **125**), serving gateways (S-GWs) **130-1** through **130**-X (referred to generically as S-GW **130**), mobility management entities (MMEs) **135-1** through **135**-M (referred to generically as MME **135**), a home subscriber server (HSS) **139**, a HeNB GW **140**, and HeNBs **145-1** through **145-3** (referred to generically as HeNB **145**). Macro cell **150** and femto cells **155-1** and **155-2** (referred to generically as femto cell **155**) may correspond to an area of coverage.

It will be appreciated that the number of devices, the connections between devices, and the macro cell and femto cell arrangements are exemplary. In other implementations, LTE **115-4** may include additional, fewer, or different devices than those illustrated in FIG. **1**B. Additionally, in other implementations, the arrangement of devices in FIG. **1**B may be different. The connections between the devices illustrated in FIG. **1**B may include wired connections and/or wireless connections.

UE **120** may include a device having communication capability. For example, UE **120** may include a wireless telephone, a computer (e.g., a laptop, a palmtop, etc.), a personal digital assistant (PDA), a gaming device, a music playing device, a video playing device, a web browsing device, a personal communication system (PCS) terminal, a pervasive computing device, and/or some other type of portable, mobile, and/or handheld user device. UE **120** may be capable of communicating with one or more devices, networks, etc., illustrated in FIG. **1**B.

ENodeB **120**, S-GW **130**, MME **135**, and HSS **139** may include network devices or entities that operate according to one or more versions of the LTE communication standard.

HeNB GW **140** may include a network device that provides access to core network **110**. For example, HeNB GW **140** may act as an intermediary node between HeNB **145** and core network **110**. HeNB GW **140** may handle various communication issues (e.g., signaling load, security, scaling, etc.) that are associated with the interconnection of HeNB **145** to core network **110**.

HeNB **145** may include a network device that provides access to end users to a mobile core network, such as, for example, core network **110**, as well as other network devices (e.g., eNodeB **125**, HeNB GW **140**, etc.). HeNB **145** may extend service coverage to home and business settings where access may be otherwise limited or unavailable. For example, HeNB **145** may include a base station. Macro cell **150** and femto cell **155** correspond to exemplary coverage areas.

Although, FIG. **1**B illustrates an exemplary LTE **115-4**, it will be appreciated that HeNB **145** and HeNB GW **140** may be incorporated into other wireless networks (e.g., GSM, WCDMA, WiMax, etc.) having a different architecture than LTE.

FIG. **2**A is a diagram illustrating exemplary components of UE **120**. As illustrated, UE **120** may include a transceiver **205**, an antenna **210**, a processing system **215**, a memory **220**, an input device **225**, an output device **230**, and a bus **235**.

Transceiver **205** may transmit information and receive information over wireless communication links (e.g., radio, microwave, etc.) via antenna **210**. Transceiver **205** may perform various communication-related processing, such as, for example, filtering, coding, decoding, modulation, demodulation, signal measuring, multiplexing, demultiplexing, error detection, and/or error correction.

Antenna **210** may receive information and transmit information via wireless communication links. Antenna **210** may include a single antenna system or a multi-antenna system (e.g., a MIMO antenna system). Antenna **210** may provide one or more forms of diversity (e.g., spatial, pattern, or polarization).

Processing system **215** may interpret and/or execute instructions. For example, processing system **215** may include a general-purpose processor, a microprocessor, a data processor, a co-processor, a network processor, an application specific integrated circuit (ASIC), a controller, a programmable logic device, a chipset, and/or a field programmable gate array (FPGA). Processing system **215** may control one or more other components of UE **120**. Processing system **215** may perform various communication-related processing, such as, for example, signal processing, channel estimation, power control, and/or timing control, as well as other operations associated with the operation and use of UE **120**.

Memory **220** may store information (e.g., data, instructions, applications, etc.). Memory **220** may include volatile memory and/or non-volatile memory. For example, memory **220** may include random access memory (RAM), dynamic random access memory (DRAM), static random access memory (SRAM), read only memory (ROM), programmable read only memory (PROM), erasable programmable read only memory (EPROM), flash memory, and/or some other form of storing hardware. Memory **220** may also include storing hardware that is external to and/or removable from UE **120**, such as, for example, a Universal Serial Bus (USB) memory and/or a Subscriber Identity Module (SIM) card.

Input device **225** may receive an input from a user and/or another device. For example, input device **225** may include a keyboard, a keypad, a touchpad, a mouse, a button, a switch, a microphone, a display (e.g., a touch screen), a port, and/or voice recognition logic.

Output device **230** may output information to a user and/or another device. For example, output device **230** may include a display, a speaker, one or more light emitting diodes (LEDs), a vibrator, a port, and/or some other type of visual, auditory, and/or tactile output device. Bus **235** may provide a communication path between components of UE **120**.

Although FIG. **2**A illustrates exemplary components of UE **120**, in other implementations, UE **120** may include fewer, additional, and/or different components than those depicted in FIG. **2**A. For example, UE **120** may include a hard disk (e.g., a magnetic disk, an optical disk, a magneto-optic disk), or some other type of computer-readable medium along with a corresponding drive. The term "computer-readable medium," as used herein, is intended to be broadly interpreted to include, for example, a storing medium (e.g., a memory, a hard disk, a compact disc (CD), a digital versatile disk (DVD), etc.). It will be appreciated that one or more components of UE **120** may be capable of performing one or more other tasks associated with one or more other components of UE **120**. Additionally, it will be appreciated that the arrangement of components depicted in FIG. **2**A may be different in other implementations.

FIG. **2**B is a diagram illustrating an exemplary CSG White List **240**. CSG White List **240** may be stored as any type of data structure (e.g., a table, a list, etc.) or arrangement of data. UE **120** may store CSG White List **240** on a storing medium (e.g., memory **220**). As illustrated in FIG. **2**B, CSG White List may include a CSG ID field **245** and an Administrator (Admin) UE indicator field **250**. UE **120** may refer to CSG White List **240** to determine which CSG(s) it can access.

CSG ID field **245** may include an identifier (e.g., a character string or an unstructured 27 bit identifier) that corresponds to a CSG. For example, a CSG ID may be broadcast as part of system information in a CSG cell (e.g., femto cell **155**).

Admin UE Indicator field **250** may include an indicator to identify an administrator level UE. This indicator can be used to enable different logic (e.g., a GUI) in the UE to enable a user to add or remove a UE **120** from the ACDB.

Although FIG. **2**B illustrates an exemplary CSG White List **240**, in other implementations, CSG White List **240**, may include additional, fewer, and/or different informational fields.

FIG. **3**A is a diagram illustrating exemplary components of HeNB **145**. As illustrated, HeNB **145** may include a transceiver **305**, an antenna **310**, a processing system **315**, a memory **320**, an interface **325**, and a bus **330**. It will be appreciated that other devices in LTE **115-4** (e.g., eNodeB **125**, S-GW **130**, MME **135**, HeNB GW **140**), may include the same or similar components.

Transceiver **305** may transmit information and receive information over wired connections (e.g., cable, xDSL, etc.) via interface **325** and wireless communication links (e.g., radio, microwave, etc.). Transceiver **305** may perform various communication-related processing, such as, for example, filtering, coding, decoding, modulation, demodulation, signal measuring, multiplexing, demultiplexing, error detection, and/or error correction.

Antenna **310** may receive information and transmit information via wireless communication links. Antenna **310** may include a single antenna system or a multi-antenna system (e.g., a MIMO antenna system). Antenna **310** may provide one or more forms of diversity (e.g., spatial, pattern, or polarization).

Processing system **315** may interpret and/or execute instructions. For example, processing system **315** may include a general-purpose processor, a microprocessor, a data processor, a co-processor, a network processor, an application specific integrated circuit (ASIC), a controller, a programmable logic device, a chipset, and/or a field programmable gate array (FPGA). Processing system **315** may control one or more other components of HeNB **145**. Processing system **315** may perform various communication-related processing, such as, for example, modulation, demodulation, error detection, and/or error correction, as well as other operations associated with the operation of HeNB **145**.

Memory **320** may store information (e.g., data, instructions, applications, etc.). Memory **320** may include volatile memory and/or non-volatile memory. For example, memory **320** may include random access memory (RAM), dynamic random access memory (DRAM), static random access memory (SRAM), read only memory (ROM), programmable read only memory (PROM), erasable programmable read only memory (EPROM), flash memory, and/or some other form of storing hardware.

Interface **325** may permit HeNB **145** to communicate with other devices, networks, and/or systems. For example, interface **325** may include an Ethernet interface, an optical interface, a coaxial interface, a DSL interface, or the like.

Bus **330** may permit communication between components of HeNB **145**.

Although FIG. **3**A illustrates an exemplary implementation of HeNB **145**, in other implementations, HeNB **145** may include fewer, additional, or different exemplary components than those depicted in FIG. **3**A. Additionally, in other implementations, the components may be arranged differently.

FIG. **3**B is a diagram illustrating an exemplary ACDB **330**. ACDB **330** may be stored as any type of data structure (e.g., a table, a list, etc.) or arrangement of data. HeNB **145** may store ACDB **330** on a storing medium (e.g., memory **320**). As illustrated, ACDB **330** may include a CSG ID field **335**, an Admin UE field **340**, and an allowed users field **345** for each CSG. In one embodiment, ACDB **330** may store similar information as CSG White List **240** (i.e., a CSG ID, and Admin UE information), as well as additional information (e.g., allowed users).

CSG ID field **335** may include an identifier (e.g., a character string or an unstructured 27 bit identifier) that corresponds to a CSG.

Admin UE field **340** may include an identifier (e.g., a character string) that corresponds to an administrator level UE. The identifier may include, for example, an International Mobile Subscriber Identity (IMSI) or some other unique identifier (e.g., an International Mobile Equipment Identity (IMEI), a Mobile Subscriber ISDN Number (MSISDN), a combination thereof, etc.). A UE identified as having an administrator level may add or remove a UE from allowed users field **345**. In this way, a user having administrator access may regulate a CSG. It will be appreciated, however, that there may be more than one Admin UE **120** per CSG. Further, the same Admin UE **120** may regulate multiple CSGs.

Allowed users field **345** may include one or more identifiers (e.g., a character string) that correspond to one or more users. For example, the identifier may include, for example, an IMSI or some other unique identifier (e.g., an IMEI, a MSISDN, a combination thereof, etc.).

Although FIG. **3**B illustrates an exemplary ACDB **330**, in other implementations, ACDB **330** may include additional, fewer, and/or different informational fields. Further, although ACDB **330** is described in relation to HeNB **145**, in other implementation, ACDB **330** may reside in a different node of LTE **115-4** (e.g., HeNB GW **140**, MME **135**, S-GW **130**), or another node (e.g., a home subscriber server (HSS) not illustrated in FIG. **1**B) to store the ACDB **330** or a portion thereof. Additionally, or alternatively, ACDB **330**, or a portion thereof, may be stored in multiple devices of LTE **115-4**.

An exemplary process is described below, in connection with FIG. **4**, in which an Admin UE **120** may update ACDB **330**. For purposes of discussion, the exemplary process will be described based on communication system **100** depicted in FIG. **1**B. However, it will be appreciated that the exemplary process may be performed in communication system **100** depicted in FIG. **1**A, in which devices different than those depicted in FIG. **1**B may be present. For example, an operation described as being performed by MME **135**, may, in a different RAN (e.g., WCDMA/UTRAN), be performed by a different device, such as, for example, a mobile switching center (MSC), a serving GPRS support node (SGSN), etc.

FIG. **4** is a flow diagram illustrating an exemplary process **400** for updating ACDB **330**. The exemplary process **400** may be performed by UE **120** that is identified as an Admin UE **120**. For example, LTE **115-4** may authenticate UE **120** as an Admin UE **120** based on a user ID (e.g. IMSI) and/or password during initial connection establishment. In this way, a user may not need to authenticate and/or identify itself as an administrator when accessing and/or managing ACDB **330**.

Process **400** may begin with connecting to ACDB **330** via non-access stratum (NAS) signaling (block **405**). For purposes of discussion, ACDB **330** may reside on HeNB **145**. In other implementations, ACDB **330** may reside on another device in LTE **115-4** (e.g., HeNB GW **140**), or another node (not illustrated in FIG. **1**B) to store ACDB **330**. Admin UE **120** may connect to core network **110** and update ACDB **330** utilizing specific NAS messages. For example, admin UE **120** may provide a user with a graphical user interface (GUI) and enabling of this functionality could be based on the CSG White List contents e.g. that the UE is indicated as Admin UE for any of the CSGs in the CSG White List. The GUI may receive input from the user and admin UE **120** may generate specific NAS signaling and transmit the NAS signaling towards MME **135**. MME **135** may map the specific NAS signaling to HeNB **145** (ACDB **330**). For example, MME **135** may map new NAS commands as database commands (e.g., as Structural Query Language (SQL) commands) to update ACDB **330**. By way of example, a new NAS command could correspond to “ADD CSG USER.” In another implementation, MME **135** may route the specific NAS signaling to HeNB **145** (ACDB **330**). In this instance, the specific NAS signaling may carry a new application capable of updating the ACDB **330**. That is, the new application may provide for the execution of database commands (e.g., SQL commands) so as to update ACDB **330**.

A UE to be added or removed may be identified (block **410**). Admin UE **120** may add or remove a user from allowed users field **345** of ACDB **330**. In one embodiment, when adding a user to allowed users field **345**, the user may enter an identifier (e.g., an IMSI) or some other type of identifier (an IMEI, a MSISDN, a combination thereof, etc.) to identify the user to be added. In another embodiment, the user may enter information (e.g., personal information) other than an identifier, which may be subsequently translated to an identifier (e.g., an IMSI, an IMEI, etc.).

A CSG cell may be identified (block **415**). Admin UE **120** may identify the CSG, associated with the user being added or removed, in CSG ID field **335**. For example, the user may enter a CSG ID that identifies the CSG.

Although FIG. **4** illustrates an exemplary process **400**, in other implementations, fewer, additional, and/or different operations may be performed.

The processes described below relate to the updating of CSG White List **240**. In this way, a user (or UE **120**) may have knowledge of which CSG(s) are accessible. For purposes of discussion, the exemplary process will be described based on communication system **100** depicted in FIG. **1**B. However, it will be appreciated that the exemplary process may be performed in communication system **100** depicted in FIG. **1**A, in which devices different than those depicted in FIG. **1**B may be present. For example, an operation described as being performed by MME **135**, may, in a different type of RAN, be performed by a different device, such as, for example, a mobile switching center (MSC), a serving GPRS support node (SGSN), etc. Similarly, an operation described as being performed by eNodeB **125**, may, in a different type of RAN, be performed by a different device, such as, for example, NodeB, radio network controller (RNC), a base station controller (BSC), a HNB Gateway (HNB GW), etc.

FIG. **5**A is a flow diagram illustrating an exemplary process **500** for updating CSG White List **240**. Process **500** may be performed by a UE **120** or an admin UE **120**. The updating of CSG White List **240** described in process **500** may be a UE-initiated process.

A search for all available CSG cell(s) may be performed (block **505**). A user may trigger a search, on UE **120**, for all detectable CSG cell(s). It will be appreciated that a detected CSG cell, as a result of the searching, may or may not be included in CSG White List **240**, which resides on UE **120**.

Access to one or more of the available CSG cell(s) may be attempted (block **510**). UE **120** may determine an available CSG cell(s) based on the searching. UE **120** may attempt to access a detected CSG cell. In one implementation, the access attempt may, for example, correspond to a Tracking Area Update towards MME **135**. The access attempt may include an identifier of UE **120**.

It may be determined whether access is granted (block **515**). A CSG cell may provide a response to UE **120**. For example, HeNB **145** may generate a response to UE **120** when attempting to access a CSG cell based on a comparison of admin UE field **340** and/or allowed users field **345** of ACDB **330** with the identifier of UE **120**. In another implementation, MME **135** may generate a response to UE **120**. For example, MME **135** may determine whether access is granted based on a comparison of the identifier of UE **120** with ACDB **330**. If it is determined that the response does not permit access to the CSG cell (block **515**—NO), then UE **120** may return to block **510** and attempt to access another available CSG cell. UE **120** may also update its CSG White List **240** (e.g., remove a CSG ID corresponding to the attempted access of the CSG cell) in instances when the CSG cell was included in CSG White List **240**.

On the other hand, if it is determined that the response permits access to the CSG cell (block **515**—YES), then UE **120** may update CSG White List **240** (block **520**). For example, UE **120** may receive a response that indicates access to the CSG cell. In the event that CSG White List **240** did not include the accessible CSG cell, UE **120** may update CSG White List **240** (e.g., add a CSG ID). UE **120** may store the updated information in CSG White List **240**. In addition, when admin UE **120** updates CSG White List **240**, admin UE **120** may add information to admin UE indicator field **250** of CSG White List **240**.

Although FIG. **5**A illustrates an exemplary process **500**, in other implementations, fewer, additional, and/or different operations may be performed. For example, if access to a CSG cell is denied, a CSG Black List could be generated and sent to UE **120**. The CSG Black List could include CSG/CSG IDs in which UE **120** is not allowed to access. In this way, UE **120** may not unnecessarily attempt to access CSG cells that it is not allowed to access.

FIG. **5**B is a flow diagram illustrating an exemplary process **550** for updating CSG White List **240**. The updating described in process **550** may be triggered by an update to ACDB **330**.

The ACDB may be updated (block **555**). Admin UE **120** may update ACDB **330**. For example, the update may include adding and/or removing a particular UE to/from a CSG. In one implementation, by way of example, admin UE **120** may identify a particular UE **120** based on the MSISDN, some other identifier, and/or personal information of user, etc. (which may or may not require conversion), to, for example, an IMSI in a home subscriber server (HSS). The HSS may then uniquely identify the particular UE **120**. By way of example, the HSS may include a database. The database may include an association between the IMSI and allowed CSG cells.

Informing the UE of the update to the ACDB may be initiated (block **560**). For example, MME **135** may initiate informing the particular UE of the update based on the update to ACDB **330**. That is, the update to ACDB **330** may constitute a triggering event to update CSG White List **240**. In one implementation, where the particular UE is not attached to the device (e.g., HeNB **145**) in which the updated ACDB **330** resides, the device (e.g., HeNB **145**) may inform core network **110** (e.g., the HSS) of the update. For example, when UE **120** attaches to MME **135**, some subscription information may be sent from the HSS to MME **135**, which may include CSG White List **240** (as a part of the subscription information). In turn, MME **135** may be capable of informing the particular UE of the update. In instances when UE **120** is already attached to the device (e.g., HeNB **145**) and HSS information is updated, the HSS may push the updated information to MME **135** that may be serving the particular UE **120**. In either circumstance, MME **135** may signal to the particular UE **120** that an update to CSG White List **240** exists.

An initial attachment to the network may be initiated (block **565**). UE **120** (i.e., the particular UE), having knowledge of the update, may perform a power cycle (e.g., a reboot, a power off and then a power on). For example, if UE **120** is in an idle mode, the power cycle may be automatic. In other instances, if UE **120** is not in an idle mode, a message or warning to the user may be provided. The user may control when the power cycle may occur (e.g., to allow the user to complete a telephone call, etc.). When the power cycle occurs, UE **120** may perform an initial attach to LTE **115-4** (e.g., between UE **120** and MME **135**).

The CSG White List may be received (block **570**). During the initial attach, MME **135** may transmit an updated portion of CSG White List **240** to UE **120**. For example, MME **135** may include the updated portion of CSG White List **240** as a part of the signaling related to the attachment process. UE **120** may then receive and store the updated CSG White List **240**.

Although FIG. **5**B illustrates an exemplary process **550**, in other implementations, fewer, additional, and/or different operations may be performed.

FIG. **6**A is a flow diagram illustrating an exemplary process **600** for updating CSG White List **240**. The updating described in process **600** may be triggered by an update to ACDB **330**, and may utilize NAS signaling.

The ACDB may be updated (block **605**). Admin UE **120** may update ACDB **330**. For example, the update may include adding and/or removing a particular UE to/from a CSG.

Informing the UE of the update to the ACDB may be initiated (block **610**). For example, MME **135** may initiate informing the particular UE of the update based on the update to ACDB **330**. That is, the update to ACDB **330** may constitute a triggering event to update CSG White List **240**. In one implementation, where the particular UE is not attached to the device (e.g., HeNB **145**) in which the updated ACDB **330** resides, the device (e.g., HeNB **145**) may inform core network **110** (e.g., the HSS) of the update. For example, when UE **120** attaches to MME **135**, some subscription information may be sent from the HSS to MME **135**, which may include CSG White List **240** (as a part of the subscription information). In turn, MME **135** may be capable of informing the particular UE of the update. In instances when UE **120** is already attached to the device (e.g., HeNB **145**) and HSS information is updated, the HSS may push the updated information to MME **135** that may be serving the particular UE **120**.

It may be determined whether the UE is in an idle mode (block **615**). For example, MME **135** (or, for example, HeNB **145**) may determine whether the particular UE is in an idle mode based on the connection state of UE **120**. If it is determined that the UE is in an idle mode (block **615**—YES), the UE may be paged (block **620**). For example, MME **135** may page UE **120**, via eNodeBs **125**, as normally to enter connected mode, for example via all eNodeBs serving cells belonging to any of the tracking areas that are part of the UE's **120** current tracking area list.

The updated CSG White List **240** may be delivered to UE **120** via NAS signaling (block **625**). MME **135** may transmit an updated portion of CSG White List **240** in a NAS signaling message.

In other instances, if the UE is not in an idle mode (block **615**—NO), then the updated CSG White List **240** may be delivered to UE **120** via NAS signaling. That is, when UE **120** is already in connected mode, MME **135** may transmit the updated portion of CSG White List **240** in a NAS signaling message.

Although FIG. **6**A illustrates an exemplary process **600**, in other implementations, fewer, additional, and/or different operations may be performed.

FIG. **6**B is a flow diagram illustrating an exemplary process **650** for updating CSG White List **240**. The updating described in process **650** may be triggered by call control (CC) signaling from an admin UE **120** to update ACDB **330**. In another implementation, the Session Initiated Protocol (SIP) may be utilized as the CC signaling protocol. It will be appreciated that CC signaling may not be utilized in a LTE communication system (as illustrated in FIG. **1**B). However, the CC signaling may be utilized in WCDMA RAN **115-2** (as illustrated in FIG. **1**A). Further, as mentioned above, communication system **100** may include circuit-switched networks. In such circumstances, CC signaling may be utilized in a circuit-switched network to update ACDB **330** in which a MSC may route update information of ACDB **330**.

The ACDB may be updated (block **655**). Admin UE **120** may update ACDB **330**. For example, as previously described in other processes described herein, an update may include adding a particular UE to a CSG. In one implementation, admin UE **120** may update ACDB **330** utilizing normal call control (CC) signaling toward core network **110**. For example, admin UE **120** may utilize a specific prefix and/or B-number to define all of the updated information. By way of example, a user of Admin UE **120** may enter a prefix function, an add or a delete, and a B number (e.g., 6781MSISDN-xyz), where "678" corresponds to a prefix function, "1" corresponds to an add (or "2" corresponds to a delete), and "MSISDN-xyz" corresponds to the B number. It will be appreciated that the order and/or the number of characters may be different. The updated information may include an updated portion of CSG White List **240** (e.g., the updated portion of ACDB **330** that corresponds to CSG White List **240**). In one implementation, as previously mentioned, CSG ID information and admin UE information may be information common to both CSG White List **240** and ACDB **330**. The updated portion of CSG White List **240** may be included in an optional information element (IE) in the CC signaling. Core network **110** (e.g., a MSC) may route the updated information to ACDB **330**.

It may be determined the particular UE to which the update of the ACDB pertains (block **660**). For example, the MSC may determine the particular UE **120** that the update of ACDB **330** pertains based on the updated information in the CC signaling (e.g., allowed users field **345**).

The call control signaling may be forwarded to the determined UE (block **665**). The MSC may forward the CC signaling to the particular UE **120**. The updated portion of CSG White List **240** may be forwarded in the optional IE in the CC signaling. In another implementation, the MSC may trigger a new call to the particular UE **120**.

The call controlling signaling may be disconnected (block **670**). The CC signaling may be disconnected and UE **120** may determine that it received the updated portion of CSG White List **240**.

Although FIG. **6**B illustrates an exemplary process **650**, in other implementations, fewer, additional, and/or different operations may be performed. For example, UE **120** may transmit an acknowledgement to core network **110** (e.g., the MSC) after the CC signaling disconnects.

FIG. **7** is a flow diagram illustrating an exemplary process **700** for updating CSG White List **240** in conjunction with a handover procedure.

The ACDB may be updated (block **705**). Admin UE **120** may update ACDB **330**. For example, the update may include adding and/or removing a particular UE to/from a CSG.

Informing the UE of the update to the ACDB may be initiated (block **710**). For example, MME **135** may initiate informing the particular UE of the update based on the update to ACDB **330**. That is, the update to ACDB **330** may constitute a triggering event to update CSG White List **240**. In one implementation, where the particular UE is not attached to the device (e.g., HeNB **145**) in which the updated ACDB **330** resides, the device (e.g., HeNB **145**) may inform core network **110** (e.g., the HSS) of the update. For example, when UE **120** attaches to MME **135**, some subscription information may be sent from the HSS to MME **135**, which may include CSG White List **240** (as a part of the subscription information). In turn, MME **135** may be capable of informing the particular UE of the update. In instances when UE **120** is already attached to the device (e.g., HeNB **145**) and HSS information is updated, the HSS may push the updated information to MME **135** that may be serving the particular UE **120**.

It may be determined whether the UE is in idle mode (block **715**). For example, MME **135** (or, for example, HeNB **145**) may determine whether the particular UE is in an idle mode based on the connection state of UE **120**. If it is determined that the UE is in idle mode (block **715**—YES), then the UE may be paged (block **720**). For example, MME **135** may page UE **120**, via eNodeBs **125** as normally, to enter a connected mode.

The UE may receive the updated CSG White List (block **725**). For example, MME **135** may transmit an updated portion of CSG White List **240** to UE **120**. UE **120** may receive and store the updated portion of CSG White List **240**. The eNodeB **125** may also be informed about the new CSG cell that UE **120** may access.

The UE may perform measurements (block **730**). UE **120** may perform channel estimation operations, cell searching operations, etc. In one implementation, UE **120** may perform one or more of these operations in response to the receipt of the updated portion of CSG White List **240**. In other implementations, UE **120** may perform one or more of these operations according to normal operations.

The UE may report the measurements (block **735**). UE **120** may report the measurements to eNodeB **125**.

It may be determined whether the new CSG cell is in the measurement report (block **740**). Since eNodeB **125** has been informed about the new CSG cell, eNodeB **125** may determine whether the new CSG cell is included in the received report. If it is determined that the new CSG cell is in the measurement report (block **740**—YES), then a handover to the new CSG cell may be triggered (block **745**). ENodeB **125** may initiate handover procedures for handing-over UE **120** to the new CSG cell (e.g., HeNB **145**). The UE may then access the new CSG cell (block **750**). Once the handover is completed, UE **120** may access the new CSG cell.

Returning to block **715**, if it is determined that the UE is not in idle mode (block **715**—NO), then the UE may receive the CSG White List (block **755**). For example, if UE **120** is already in connected mode, MME **135** may transmit the updated portion of CSG White List **240** to UE **120**. UE **120** may receive and store the updated portion of CSG White List **240**.

Blocks **760** and **765** may correspond to blocks **730** and **735** previously described.

Returning to block **740**, if it is determined that the new CSG cell is not in the measurement report (block **740**—NO), then a handover to the new CSG cell may not be triggered (block **770**). That is, eNodeB **125** may not initiate handover procedures for handing-over UE **120** to the new CSG cell (e.g., HeNB **145**).

Although FIG. **7** illustrates an exemplary process **700**, in other implementations, fewer, additional, and/or different operations may be performed.

FIG. **8** is a flow diagram illustrating an exemplary process **800** for updating ACDB **330** and CSG White List **240**. As described in process **800**, ACDB **330** may include an additional informational field (e.g., a password field—not illustrated in FIG. 3B.) The password field may store a secret and/or unique password (or some other type of identifier) that may be used for authentication purposes. In one implementation, the password or identifier may be generated, at least in part, based on the HeNB **145** identity (e.g., a medium access control (MAC) address of one of the HeNB **145** backhaul interfaces). Additionally, or alternatively, there may be different types of passwords. For example, there may be a password for administrators and a password for guests or users, which may correspond to admin UE **120** or UE **120**, respectively. Process **800** may be performed by UE **120** or admin UE **120**.

A search for available CSG cell(s) may be performed (block **805**). A user may trigger a search, on UE **120**, for all detectable CSG cell(s). It will be appreciated that a detected CSG cell, as a result of the searching, may or may not be included in CSG White List **240**, which resides on UE **120**.

An attempt to access an available CSG cell may be performed (block **810**). UE **120** may determine an available CSG cell(s) based on the search. UE **120** may attempt to access a detected CSG cell.

A password may be transmitted to a HeNB to access the available CSG cell (block **815**). For example, UE **120** may transmit a password (or some other type of identifier) in the radio resource control (RRC) signaling towards HeNB **145**. The password may be, for example, an administrative-level password, a user-level password, or a guest-level password.

It may be determined whether the transmitted password matches another password (block **820**). HeNB **145** may determine whether the transmitted password matches another password stored in ACDB **330**. For example, in a core network (CN)-based access control scenario (e.g., where ACDB **330** resides in core network **110**, such as MME **135**), MME **135** may have knowledge of the IMSI of the attached UE **120**. HeNB **145** may transmit the received password and the CSG ID to MME **135**. MME **135** may determine whether access should be granted.

In another scenario, such as a RAN-based access control (e.g., where ACDB **330** resides in a RAN), HeNB **145** may not have the IMSI of the attached UE **120**. HeNB **145** may use NAS signaling (e.g., an Identity Request) to obtain the IMSI of UE **120**. Once the IMSI is obtained, HeNB **145** may determine whether access should be granted.

If it is determined that the password matches (block **820**—YES), then access may be granted (block **825**). UE **120** may be granted access to the available CSG cell. That is, based on the password matching and corresponding identifier of UE **120**, UE **120** may be granted access to an appropriate CSG. The access grant may indicate whether UE **120** corresponds to an administrative level device (i.e., an Admin UE **120**) or a non-administrative level device (e.g., UE **120** that may used by users, guests, etc.).

A CSG White List may be updated (block **830**) and a ACDB may be updated (block **835**). Once UE **120** or admin UE **120** is granted access, CSG White List **240** and ACDB **330** may be updated. For example, when UE **120** corresponds to an admin UE **120**, then fields **245** and **250** may be appropriately updated in CSG White List **240**. Additionally, fields **335**, **340**, and **345** may be appropriately updated in ACDB **330**. On the other hand, when UE **120** is not an admin UE, then fields **335** and **345** may be updated, as well as field **245**.

On the other hand, if it is determined that the password does not match (block **820**—NO), then access may be denied (block **845**). In this case, UE **120** may return to block **805** or block **810**. UE **120** may update CSG White List **240** (e.g., CSG ID) based on the denial, for example, in instances that CSG White List **240** included the denied CSG.

Alternatively, UE **120** may terminate process **800**. Although FIG. **8** illustrates an exemplary process **800**, in other implementations, fewer, additional, and/or different operations may be performed.

The foregoing description of implementations provides illustration, but is not intended to be exhaustive or to limit the implementations to the precise form disclosed. Modifications and variations are possible in light of the above teachings or may be acquired from practice of the teachings. For example, as previously mentioned, description of processes and/or operations with respect to an LTE communication system may be adapted to other communication platforms. Thus, mention of a particular device (e.g., an MME, etc.) within the description of the embodiments and implementations described herein should not be limited to this particular device. Rather, any operation and/or process described herein may be performed by another device, in addition to, or instead of, the device described. Thus, for example, a device, of a communication platform different than LTE, that provides similar functionality within the different communication platform, may be adapted to perform the processes and/or operations as described herein.

In addition, while series of blocks have been described with regard to the processes illustrated in FIGS. **5**A, **5**B, **6**A, **6**B, **7** and **8**, the order of the blocks may be modified in other implementations. Further, non-dependent blocks may be performed in parallel. Further one or more blocks may be omitted. It will be appreciated that one or more of the processes and/or operations described herein may be implemented as a computer program. The computer program may be stored on a computer-readable medium (e.g., a memory, a hard disk, a CD, a DVD, etc.) or represented in some other type of medium (e.g., a transmission medium).

It will be apparent that aspects described herein may be implemented in many different forms of software, firmware, and hardware in the implementations illustrated in the figures. The actual software code or specialized control hardware used to implement aspects does not limit the invention. Thus, the operation and behavior of the aspects were described without reference to the specific software code—it being understood that software and control hardware can be designed to implement the aspects based on the description herein.

Even though particular combinations of features are recited in the claims and/or disclosed in the specification, these combinations are not intended to limit the disclosure of the invention. In fact, many of these features may be combined in ways not specifically recited in the claims and/or disclosed in the specification.

It should be emphasized that the term "comprises" or "comprising" when used in the specification is taken to specify the presence of stated features, integers, steps, or components but does not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof.

No element, act, or instruction used in the present application should be construed as critical or essential to the implementations described herein unless explicitly described as such.

The term "may" is used throughout this application and is intended to be interpreted, for example, as "having the potential to," configured to," or "capable of," and not in a mandatory sense (e.g., as "must"). The terms "a" and "an" are intended to be interpreted to include, for example, one or more items. Where only one item is intended, the term "one" or similar language is used. Further, the phrase "based on" is intended to be interpreted to mean, for example, "based, at least in part, on," unless explicitly stated otherwise. The term "and/or" is intended to be interpreted to include any and all combinations of one or more of the associated list items.

What is claimed is:

1. A method performed in a communication system by a device that is communicatively coupled to the communication system, the method comprising:

receiving an indication that an access control database has been updated, the access control database comprising an administrative level user equipment field;

performing a power cycle to re-attach to the communication system based on the indication; and

updating a closed subscriber group (CSG) White List;

wherein the CSG White List indicates to the device at least one CSG cell the device is allowed to access; and

wherein the CSG White List is updatable by the device responsive to a CSG cell Tracking Area Update access attempt by the device so as to remove one of the at least one CSG cell corresponding to the CSG cell Tracking Area Update access attempt from the CSG White List when the CSG cell Tracking Area Update access attempt is not successful.

2. The method of claim **1**, further comprising:

receiving an updated portion of the CSG White List from another device.

3. The method of claim **2**, wherein the another device comprises a mobility management entity (MME), a mobile switching center (MSC), or a Serving General Packet Radio Service (GPRS) Support Node (SGSN).

4. The method of claim **1**, wherein the device comprises a user equipment and the at least one CSG cell comprises at least one femto cell.

5. A method performed in a communication system that includes at least one closed subscriber group (CSG) cell, the method comprising:

updating an access control database that specifies which of at least one user equipment is allowed to access the at least one CSG cell, the access control database comprising an administrative level user equipment field;

informing a device, which is communicatively coupled to one of the at least one user equipment to which the updating of the access control database pertains of the updating of the access control database, wherein the device performs a power-cycle to re-attach to the communication system based on the informing of the updating, and

providing a CSG White List to the one of the at least one user equipment;

wherein the CSG White List indicates to the one of the at least one user equipment the at least one CSG cell that the one of the at least one user equipment is allowed to access; and

wherein the CSG White List is updatable by the device responsive to a CSG cell Tracking Area Update access attempt by the device so as to remove one of the at least one CSG cell corresponding to the CSG cell Tracking Area Update access attempt from the CSG White List when the CSG cell Tracking Area Update access attempt is not successful.

6. The method of claim **5**, where the providing comprises:

determining whether the one of the at least one user equipment is in an idle mode; and

paging the one of the at least one user equipment if the one of the at least one user equipment is determined to be in the idle mode.

7. The method of claim **5**, where the providing comprises:

providing the CSG White List in a non-access stratum (NAS) message.

8. A device capable of operating in a communication system, comprising:

a processing system configured to:

receive an indication that an access control database has been updated, the access control database comprising an administrative level user equipment field;

perform a power cycle to re-attach to the communication system based on the indication; and

update a closed subscriber group (CSG) White List;

wherein the CSG White List indicates to the device at least one CSG cell the device is allowed to access; and

wherein the CSG White List is updatable by the device responsive to a CSG cell Tracking Area Update access attempt by the device so as to remove one of the at least one CSG cell corresponding to the CSG cell Tracking Area Update access attempt from the CSG White List when the CSG cell Tracking Area Update access attempt is not successful.

9. The device of claim **8**, wherein the device comprises a user equipment and the at least one CSG cell comprises at least one femto cell.

10. The device of claim **8**, wherein the CSG White List is automatically received from the communication system during the re-attaching.

11. The device of claim **10**, wherein the device comprises a second CSG White List and the received CSG White List is an updated version of the second CSG White List of the device.

12. A device capable of operating in a communication system having at least one closed subscriber group (CSG) cell, the device comprising:

a processing system configured to:

receive an indication that an access control database has been updated, the access control database comprising an administrative level user equipment field, where the access control database specifies which of at least one user equipment is allowed to access the at least one CSG cell;

determine to which of the at least one user equipment that the updated access control database pertains; and

inform a device, which is communicatively coupled to one of the at least one user equipment to which the updating of the access control database pertains of the updating of the access control database, wherein the device performs a power-cycle to re-attach to the communication system based on the informing of the updating;

deliver an updated CSG White List to the determined at least one user equipment, where the updated CSG White List indicates to the determined at least one user equipment which of the at least one CSG cell the determined at least one user equipment is allowed to access;

wherein the CSG White List is updatable by the at least one user equipment responsive to a CSG cell Tracking Area Update access attempt by the at least one user equipment so as to remove one of the at least one CSG cell corresponding to the CSG cell Tracking Area Update access attempt from the CSG White List when the CSG cell Tracking Area Update access attempt is not successful.

13. The device of claim **12**, where the device comprises a mobility management entity (MME).

14. The device of claim **12**, where the processing system is further configured to:

page the determined at least one user equipment before delivering the updated CSG White List when the determined at least one user equipment is determined to be in an idle mode.

15. The device of claim **12**, where the updated CSG White List is delivered in a non-access stratum (NAS) message.

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